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9 The Agricultural Business

A fundamental task of the chemical industries since their beginning has been the support of agriculture. Today supplying the six billion inhabitants on Earth with food is more a problem of distribution than of production. The main problem is, run the arguments of some agricultural scientists, that not enough food is produced in places where it is urgently needed. However, it is questionable if the increase in food supply can match the increase in population. Furthermore, with slowly increasing wealth the population of developing states will change their nutritional behavior. Forecasts claim that a 40 % increase in the supply of cereals and rice would be necessary until 2020. Without biotechnology, specifically genetically modified plants, this increase in output and efficiency in agriculture seems unachievable. Therefore, in spite of all criticism in Western countries from their well-nourished population, scientists are optimistic for the future of biotechnology.

9.1 General Trends

The agricultural business (“agrobusiness”), understood classically, comprised basic chemicals like fertilizers and all substances for plant protection in a broad sense, especially pesticides, herbicides, and fungicides. When plant protection became more sophisticated, this branch was designated as a part of the life sciences. Together with pharmaceuticals, these substances should have formed the core business of the companies which formulated their new strategy in this way. However, the expected synergies, coming from the technology of fine chemicals, could not be made manifest. Furthermore the agrobusiness divisions suffered from the cyclic nature of the business and the lack of public acceptance. These developments were very rapid in these branches and they have therefore diverged from a common origin: Pharmaceuticals and plant protection are too different in development, application, and marketing. It comes therefore as no surprise that only a few years after the declaration of the “lifescience concept” some companies tried to divest their agricultural divisions. The Swiss Novartis and the British–Swedish AstraZeneca announced in December 1999 the repositioning of their branches into a new, separate joint entity for agrochemicals and seeds with the new name “Syngenta”. This constellation should have a turnover of an estimated € 8 billion

and economizing effects are expected above all in distribution and administration. Monsanto and Pharmacia & Upjohn revealed a similar strategy, which also announced a separation of their agrobusinesses in the course of the planned fusion and to go public with this new entity. In March 2000, BASF announced the acquisition of the plant-protection activities of American Home Products (AHP), accelerating the global trend in concentration. The seven leading companies in agrobusiness meanwhile have about 80 % of the world market and earn about 50 % of their turnover through herbicides. Figure 9-1 shows the major producers of agrochemicals.

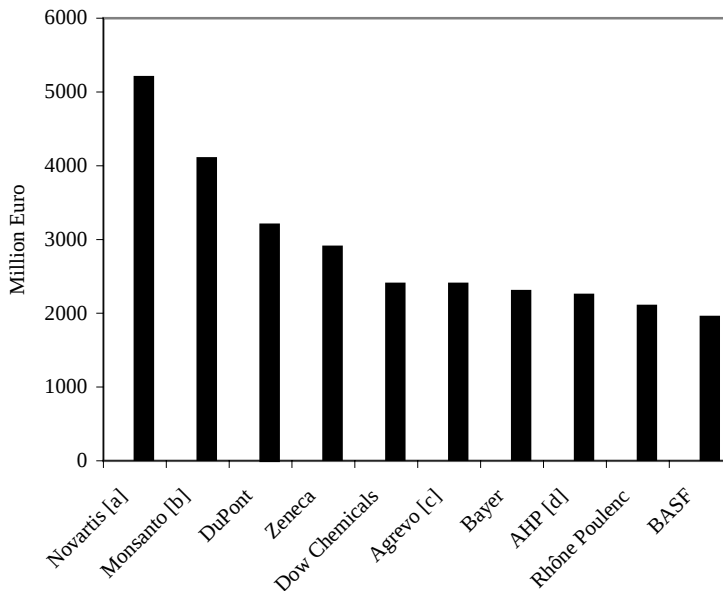


Figure 9-1 Major producers of agrochemicals, as measured by their estimated 1998 turnover. [a] Fused with AstraZenca in 1999. [b] Fusion with Pharmacia-Upjohn. [c] Hoechst/Schering. [d] Now together with Monsanto.

In connection with a complete restructuring of the agrobusinesses, the biotechnology and genetically modified seeds areas have already been developed into a special business branch. Furthermore, another newly arisen business branch, functional food and nutraceuticals, has arisen to take a position between food and pharmaceuticals.

9.2 Pesticides, Herbicides, and Fungicides

The world market for these three categories of chemicals is estimated for the year 2000 at about € 30 billion, distributed into 55 % herbicides, 25 % fungicides, 10 % pesticides, and other substances for the remainder. Within this remainder category fall modern biological plant-protection methodologies, such as the use of a specific fungus to control plant parasites. This elegant plant-protection method continually gains in market share due to its stricter control of residues in food. A special issue in marketing of chemicals for plant protection is the demonstration of nontoxicity for other animals and, thereby, having a clean bill of health granted. Therefore natural toxins or derivatives of natural substances are favored. As an example, the class of strobilurines for the protection of cereals have gained a broad acceptance in agricultural applications. An overview of the leading players in crop sciences is given in Figure 9-2, and Figure 9-3 shows the major producers of plant protection agents.

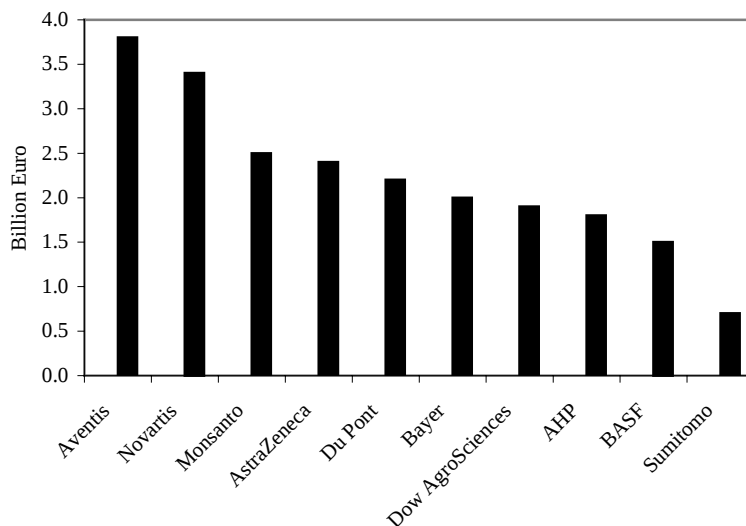


Figure 9-2 Major players in the crop science market according to estimated 1998 sales

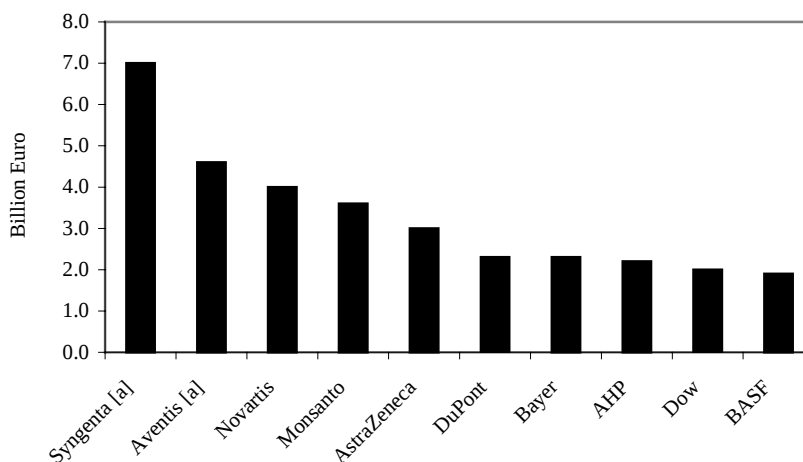


Figure 9-3 Major producers of plant protective agents according to estimated 1998 turnover. [a] Based on invoices sent

Other well-known substances like the insecticide DDT have practically disappeared from the Western markets after the accident at Seveso (Section 4.4). DDT and other substances developed in this time gave agrobusiness the image of “overkill chemistry”. With increased popular awareness the demand for “smarter and softer” chemistry arose, especially in the agricultural and food industry. However, as a consequence of the withdrawal of DDT in equatorial and African countries, malaria returned, which had been significantly reduced through the broad application of DDT. The World Health Organization (WHO), a suborganization of the United Nation, reports the worldwide return of malaria; cases have been reported even in Southern Italy.

With the assistance of the FAO (Food and Agriculture Organization), another suborganization of the United Nations, 95 nations have agreed on an international convention for the trade of dangerous chemicals and pesticides. The creation of an information system enables especially countries in transformation to be notified about substances banned in industrial nations. Exporting countries are obliged to place information prior to any delivery.

Today the trends of agricultural pest-control chemicals favor those with high efficiencies, narrow application ranges, species specific, and shorter shelf lifetimes. This has turned the marketing strategy into one of application advice, thereby adding service value. This service comprises not only a standard information but refers to the specific environment of the farmers. Dosage, time, and application methodology are tailored. In the USA, with its large farming areas, even air or satellite surveillance of plant diseases and fertilizer application is offered. In this way, even a

commodity like fertilizer is upgraded with a high-technology service. This again is a good example that a product at the end of its lifecycle or a commodity can be relaunched with added value through service.

9.3 Genetically Modified Seeds

Agriculture is a growing industry. It will have to meet the challenge to provide food for an increasing population, estimated at 8.5 billion people by 2025. Besides increasing quantity, the demands from consumers as well as from farmers change. Agrobusinesses can be regarded from their input and output sides. Increasing the output by the application of fertilizers and chemicals to prevent or reduce the loss of harvests by parasites is one possibility, while the other is to produce under a given environment greater quantities of food, namely an increase in efficiency. The last approach is followed by biotechnology. An increase in efficiency is the only approach which is in accordance with the concept of sustainable development because traditional ways of farming consume more resources than they create. Contrary to the sentimental glorification of traditional farming, also called “biological agriculture”, it has to be made quite clear that this policy would decrease, instead of increase, efficiency and allow the gap to broaden between food supply and demand in the world.

Meanwhile about 40 million hectares (99 million acres) of genetically modified plants are already cultivated worldwide (compare Tables 9-1 and 9-2), which represents an area the size of Germany and the Netherlands combined. Half of the area is used for soy beans, about 30 % for corn, as well as for cotton and rape plants. However, only a few countries allow the agriculture of modified plants, among them the USA which represents three quarters of the area. According to the protests in Western Europe against the use of soybean oil from modified plants, a temporary decrease in the USA is also expected. A significant increase in transgenic crops, however, can be observed in countries in transition. China, as a progressive developing country, has meanwhile maintained the second position in transgenic plant cultivation with an estimated area of plantation of 4.5 million hectares (11 million acres), followed by Argentina and Canada (Figure 9-4).

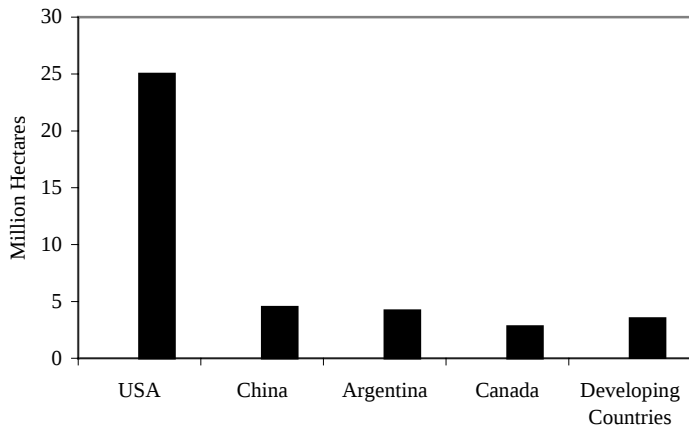


Figure 9-4 Areas with transgenic plants (world total 40 million hectares)

Table 9-1 Producers of seeds

Company	Country	Million Euro
Pioneer	USA	1800
Novartis	Switzerland	1150
Limagrain	France	780
Monsanto	USA	750
Advanta	The Netherlands	550
Takii	Japan	500
Dekalb	USA	430
Seminis	Mexico	430
Sakata	Japan	410
KWS	Germany	400
Cargill	USA	300
Cebeco	The Netherlands	210
Pau Euralis	France	200
Svalöl Weibull	Sweden	200
RAGT	France	180
Mycogen	USA	180
Saaten-Union	Germany	160
Sigma Semences	France	150
DLF Trifolium	Denmark	150
Barenberg	The Netherlands	140

Table 9-2 Examples of transgenic plants

Plant	Trade name	Producer
Cotton	BXN Cotton	Calgene
Cotton	Bollgard	Monsanto
Cotton	Roundup Ready	Monsanto
Potato	New Leaf Potato	Monsanto
Maize (Corn)	Maximizer	Novartis
Maize (Corn)	Nature Gard	Novartis
Maize (Corn)	Event 176	Novartis
Maize (Corn)	Liberty Link	AgrEvo
Maize (Corn)	Yield Guard	Monsanto
Maize (Corn)	Seed Link	Plant Genetic System
Maize (Corn)	B16	DeKalb
Rape	Laurical	Calgene
Rape	Roundup Ready	Monsanto
Rape	Innovator	AgrEvo
Soybean	Roundup Ready	Monsanto
Tomato	FlavrSavr	Calgene
Tomato	Endless Summer	DANN Plant Tech

Currently, however, the acceptance of genetically modified foods in several European countries is quite low. Once again, management in the corresponding companies and researchers have failed to inform the population at an early stage about the benefits of a new technology, almost as if the disaster of the anti-PVC campaign had not shown the industry clearly enough what can occur when sleepy management neglects an appropriate marketing strategy. Again, the incredibly dilettante public relations of this industry has left the initiative to the so-called environmentalists. The saturated consumer does not recognize the benefit of a “FlavrSavr” tomato, and while this product is not of overwhelming importance it is a necessary step in acquiring experience for more important modified plants, such as new vitamin-producing plants.

However, there are also the arguments of critics that lead us in an important direction, namely promises by companies to increase the harvests by using certain herbicide- or parasite-resistant transgenic plants like Bt-176 maize (that contains a gene from *Bacillus thuringiensis*). Here, the “terminator technology” prevents poor farmers from reusing seeds and are therefore forced buy new seedlings each year. This kind of marketing is perspicuous but clearly shows that some companies tried to gain a monopolistic market position. This is not at all in accordance with a marketing strategy trying to win acceptance of a new product. Such are the inconsistencies in the companies’ strategies, which undermine their own goodwill campaigns.

A much smarter approach with better chances of popular acceptance is the cultivation of plants like the “golden rice”, genetically engineered to contain beta-carotene, which gives the rice a golden color. Of course it is not the color but the

precursor of vitamin A which makes this plant very valuable, especially as it could help to fight against childhood blindness arising from vitamin-deficiency diseases.

9.4 Plants as Chemical Reactors

The cultivation of plants such as rape, linseed, or sunflower to produce oils is long established. The production of rape oil in Germany amounted to about 100 000 tonnes in 1999 with an expected dramatic increase to 300 000 by 2001, principally for fuel. The production of biofuel, however, will not substitute for more than 5 % of the total demand of diesel oil. Currently in the European Union, there seems to be an oversupply of such oils. The reason may be one of these unusual EU agricultural regulations that state farmers will receive a premium of € 300 for each hectare not cultivated but, for whatever reason, this subsidy will not be invalid when rape is planted. The estimated area of cultivation for industrial substances rather than food in Germany was reported to be half a million hectares in 1999. Furthermore, the methyl ester of castor oil, the substitute for diesel, is exempted from tax. Prices for castor oil fluctuate on the world market between € 600 and € 1200 per tonne. Other plant oils are used as lubricants, plasticizers, release agents, or for the cosmetic industry.

New possibilities, however, arise with genetically modified plants used as biological reactors for the production of yet more sophisticated products. Experiments are underway to produce “silk” from a bacterium with a spider gene. Other high-technology bacteria could produce organic hydroxyacids for direct condensation to polyesters. It is possible that in near future a new market segment will be created, in which complex chemicals are “cultivated” on a farm.

9.5 Functional Food

A long-held dream is that medicine or vaccines can be delivered through ingestion of simple food. This kind of food is called functional food and represents a link between pharmaceuticals and genetically modified plants. As a matter of fact, one of the most interesting new business areas arises here. Already commercially available is “prebiotic food”, such as the lactobacillus-containing yogurts, which are said to stimulate flora in the stomach. The worldwide turnover with these prebiotic foods is estimated to about € 11 billion with annual increase rates of more than 40 %. The

new word for this kind of products is nutraceuticals. Other more challenging experiments includes the genetic modification of potatoes with a cholera toxin: Especially in poor countries with an insufficient water supply, cholera is a severe and dangerous problem, and the possibilities of vaccination are limited. Other foodstuff could be modified with cholesterol-repressing genes or with properties that protect against different kinds of cancer.

The positioning in the market will cause difficulties because of the separation of functional food from the legislation for pharmaceuticals. Nutraceuticals are positioned in an area between food and pharmaceuticals. Only in Japan do laws for this new class already exist, in the USA the Food and Drug Administration is responsible for the admission of health-related public relation, while in Europe “health claims” are mostly forbidden.

A new focus may also be put on food containing natural substances—albeit in tiny quantities—which have shown biological activity against certain diseases. The most known ones are omega-3 fatty acids. Less known are the phytochemicals, like isothiocyanates, isoflavones, and phytoestrogens, and antioxidants like catechines which are said to activate the immune system.

9.6 Legal Aspects

The enormous investments of companies in the development of transgenic plants must be compensated by a reasonable return of cash flow. Therefore patent laws guarantee firms protection of marketing rights for a specified time. This is a usual procedure, recognized by most nations, otherwise there would be no incentive to spend money for research. Concerning the cultivation of plants, a similar “protection of sorts” exists based on the International Agreements on the Protection of Sorts of 1961. However, normally it is rather difficult to get a protection of sorts and therefore producers apply for ordinary patents for their transgenic plants. About 1500 demands are waiting in the European Patent Office in Munich. According to the European Guidelines on Bio-Patents of 1997, plants had been excluded from patent protection, whereas patents on single genes are allowed. Patents on transgenic plants or human or animal genes are problematic. The creation by farmers of their own seedlings—a practice since the beginning of systematic agriculture—would be a violation of patent rights under the new situation. In other words, farmers were obliged to buy new seeds from the producing company each year, which is unaffordable especially for farmers in developing countries. The argument from marketing, that these transgenic plants were especially designed for farmers in third-world countries, immediately becomes ridiculous and destroys what remains of their credibility. A group of critics in the USA has announced their intention to bring an anti-trust suit against firms who follow this terminator strategy. The highest European patent court in Munich, acting on a complaint of Novartis

against a sentence of 1995, decided on December 20th, 1999, to grant protection also for genetically modified plants and animals. Details, however, are not yet clear, especially if the agreement does not impact the free-trade treaties of the World Trade Organization. Table 9-1 lists the leading seed producers, including both unmodified and transgenic seeds.

According to the Montreal protocol on biological safety of January 29th, 2000, the European Community has now overcome concerns from the American government against the obligatory labeling of transgenic products. The protocol says that genetically modified plants and animals are only allowed for export if the importing nation has agreed beforehand. The agreement shall be enacted in 2003.

Other new regulations—partly also in connection with plant protection—are concerned with the use of chemicals such as DDT. The so-called persistent organic pollutants (POP) convention of the United Nation's Environmental Program (UNEP), a successor of the Montreal convention, addresses the reduction and banning of dangerous substances. However, the poorest nations still use DDT to protect their population from malaria as they cannot afford modern pharmaceuticals, and the development of a vaccine seems unprofitable to the pharmaceutical industries.